

REMARKS

Applicants have studied the Office Action dated November 12, 2003 and have made amendments to the claims. It is submitted that the application, as amended, is in condition for allowance. By virtue of this amendment, claims 1-9 and 18-30 are pending. Claims 1, 20-22, and 25 have been amended, and new claims 29 and 30 have been added. Reconsideration and allowance of the pending claims in view of the above amendments and the following remarks are respectfully requested.

Claims 1-7, 18-22, and 25 were rejected under 35 U.S.C. § 102(b) as being anticipated by Charoensakvirochana et al. (U.S. Patent No. 4,644,384). Claims 8, 9, 23, 24, 27, and 28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Charoensakvirochana et al. in view of Herbst (U.S. Patent No. 5,913,110). These rejections are respectfully traversed.¹

The present invention is directed to improved injection molds that can be used to fabricate semiconductor packages containing an integrated circuit chip encapsulated in a transparent encapsulation material. One preferred embodiment provides an injection mold for encapsulating an integrated circuit chip in an encapsulation material so as to form a semiconductor package containing the chip. The injection mold includes at least one injection cavity defined by a wall, and an insert. The injection cavity is able to house the chip and receive the encapsulation material so as to encapsulate the chip in a block of the encapsulation material.

¹ Applicants note that for many of the rejected claims the Examiner only recited the claim language and stated that the cited reference taught the recited limitation(s). However, these are no more than conclusory statements. To make out a prima facie case of anticipation under 35 U.S.C. § 102(e), the Examiner must show that every limitation of every rejected claim is taught by the cited reference. Applicants cannot properly respond to a rejection containing only a conclusory allegation that the cited reference teaches all of the limitations of the rejected claim. It is respectfully requested that, when making any rejections, the Examiner specifically explain how the cited reference teaches each limitation of each rejected claim, with the necessary citations to where such teachings can be found in the cited reference, so that Applicant can fully understand and properly respond to such rejections.

The insert is fixedly attached so as to have a transverse surface that lies parallel to one face of the chip and a front part that forms a portion of the wall of the injection cavity such that the encapsulation material is able to contact the transverse surface of the insert during encapsulation so that the transverse surface of the insert determines the roughness of a region of the face of the block of encapsulation material that corresponds to the transverse surface of the insert.

The transverse surface of the insert has a roughness that is chosen such that the face of the block of encapsulation material of the semiconductor package has a suitable roughness in the region of the face of the block of encapsulation material corresponding to the transverse surface of the insert. Because the insert is fixed such that during encapsulation the encapsulation material is able to contact the transverse surface of the insert so that the transverse surface of the insert determines the roughness of the corresponding region of the face of the block of encapsulation material, it is possible to manufacture a cavity having a wall with a normal roughness and to have a much lower roughness only on the transverse face of the insert. This is easier and less costly than carrying out a polishing operation on the wall of the cavity.

The Charoensakvirochana reference is also directed to an injection mold for forming a semiconductor package. However, Charoensakvirochana does not disclose an injection mold for encapsulating an integrated circuit chip in an encapsulation material so as to form a semiconductor package containing the chip, with the injection mold including an insert fixedly attached so as to have a transverse surface that lies parallel to one face of the chip and a front part that forms a portion of the wall of an injection cavity such that the encapsulation material is able to contact the transverse surface of the insert during encapsulation so that the transverse surface of the insert determines the roughness of a region of the face of the block of encapsulation material that corresponds to the transverse surface of the insert, as is recited in amended claim 1. Amended claim 20 contains similar recitations.

Charoensakvirochana discloses an injection mold having an insert that functions to form a window through a portion of the encapsulation block. More specifically, Charoensakvirochana discloses an injection mold 40 that has upper and lower parts 42 and 44 that define a mold cavity 46, as shown in Figure 5. The upper part 42 of the mold has a plug cavity 48 that holds a rubber plug 50 that is slightly longer than the plug cavity 48. When the mold is closed for

encapsulation, the transverse (lower) surface of the plug 50 is compressed against the upper surface of the subassembly 36 that hermetically encloses the chip 12. This forms a seal that isolates the portion of the subassembly 36 that is covered by the transverse surface of the plug 50 from the mold cavity 46. Thus, in the injection mold of Charoensakvirochana, the encapsulation material is prevented from contacting the transverse surface of the plug 50 and covering the corresponding portion of the subassembly 36, so that a window 14 is formed through the block 10 of encapsulation material in the region corresponding to the plug 50.

In contrast, preferred embodiments of the present invention provide an injection mold having an insert that is fixedly attached so that the transverse surface of the insert determines the roughness of a region of the face of the block of encapsulation material that corresponds to the transverse surface of the insert. More specifically, in one embodiment, the injection mold includes an insert and at least one injection cavity that is defined by a wall. The insert is fixedly attached so that its transverse surface lies parallel to one face of the chip and its front part forms a portion of the wall of the injection cavity such that the encapsulation material is able to contact the transverse surface of the insert during encapsulation so that the transverse surface of the insert determines the roughness of a corresponding region of the face of the block of encapsulation material. Additionally, the roughness of the transverse surface of the insert is chosen such that the corresponding region of the face of the block of encapsulation material of the semiconductor package has a suitable roughness.

Charoensakvirochana does not teach or suggest an injection mold an injection mold having an insert that is fixedly attached so that the transverse surface of the insert determines the roughness of a region of the face of the block of encapsulation material that corresponds to the transverse surface of the insert. In the injection mold disclosed in Charoensakvirochana, the rubber plug is not fixedly attached, but instead is simply placed in the plug cavity in the upper part of the mold. Further, the transverse (lower) surface of the plug contacts the face of the subassembly (ceramic package) so that a window is formed through the block of encapsulation material in the region corresponding to the plug.

In other words, no encapsulation material comes in contact with the transverse surface of the plug, so the transverse surface of the plug does not determine the roughness of any region of

the face of the block of encapsulation material of the semiconductor package. Instead, the compressed plug operates to form an opening that passes completely through the block of encapsulation material. Additionally, because the opening is formed through the block of encapsulation material in the region corresponding to the plug, it is impossible for the roughness of the transverse surface of the plug to be chosen so that a region of the face of the block of encapsulation material of the semiconductor package corresponding to the plug has a suitable roughness.

Applicants believe that the differences between Charoensakvirochana and the present invention are clear in amended claims 1 and 20, which set forth injection molds according to embodiments of the present invention. Therefore, claims 1 and 20 distinguish over the Charoensakvirochana reference, and the rejection of these claims under 35 U.S.C. § 102(b) should be withdrawn.

As discussed above, amended claim 1 distinguishes over the Charoensakvirochana reference. Furthermore, the claimed features of the present invention are not realized even if the teachings of Herbst are incorporated into Charoensakvirochana. Herbst does not teach or suggest the claimed features of the present invention that are absent from Charoensakvirochana. Thus, amended claim 1 distinguishes over the Charoensakvirochana and Herbst references, and thus, claims 2-9, 18, and 19 (which depend from claim 1) also distinguish over the Charoensakvirochana and Herbst references. Therefore, it is respectfully submitted that the rejections of claims 1-9, 18, and 19 under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a) should be withdrawn.

Applicants thank the Examiner for indicating that claim 26 would be allowable if rewritten to include all of the limitations of the base claim and any intervening claims. Claim 21 has been rewritten in independent form and amended to include the limitation of claim 26 (with the addition of the term "substantially"). Claims 22-28 now depend from amended claim 21. Thus, claims 21-28 should now be allowable over the art of record. Therefore, it is respectfully



-12-

submitted that the rejections of claims 21-28 under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a) should be withdrawn.

Claims 29 and 30 have been added by this amendment, and are provided to further define the invention disclosed in the specification. Claims 29 and 30 are allowable for at least the reasons set forth above with respect to claims 1-9 and 18-28.

In view of the foregoing, it is respectfully submitted that the application and the claims are in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is invited to call the undersigned attorney at (561) 989-9811 should the Examiner believe a telephone interview would advance the prosecution of the application.

Date: May 12, 2004

Respectfully submitted,

By: 

Stephen Bongini
Registration No. 40,917
Attorney for Applicants

FLEIT, KAIN, GIBBONS,
GUTMAN, BONGINI & BIANCO P.L.
One Boca Commerce Center
551 Northwest 77th Street, Suite 111
Boca Raton, Florida 33487
Telephone: (561) 989-9811
Facsimile: (561) 989-9812